

CLAIMS

What is claimed is:

- 1 **1.** An electromagnetic transducer comprising:
2 a motor structure including a magnetic air gap;
3 a voice coil disposed within the magnetic air gap; and
4 a diaphragm coupled to the voice coil, wherein the diaphragm has an overall mass density
5 lower than 0.01g/cm^3 .
- 1 **2.** The electromagnetic transducer of claim 1 wherein the diaphragm has an overall mass
2 density lower than 0.005g/cm^3 .
- 1 **3.** The electromagnetic transducer of claim 1 wherein the diaphragm comprises a
2 nanoporous material.
- 1 **4.** The electromagnetic transducer of claim 3 wherein the nanoporous material comprises at
2 least one of aerogel, solgel, and nanocomposite material.
- 1 **5.** The electromagnetic transducer of claim 3 wherein the diaphragm further comprises a
2 skin.
- 1 **6.** The electromagnetic transducer of claim 5 wherein the skin encapsulates the entire
2 diaphragm.
- 1 **7.** The electromagnetic transducer of claim 5 wherein the skin comprises at least one of a
2 sputtered layer, a chemical vapor deposition layer, and a vacuum deposited layer.
- 1 **8.** The electromagnetic transducer of claim 5 wherein the skin comprises at least one of
2 metal, plastic, and oxide.
- 1 **9.** The electromagnetic transducer of claim 1 wherein the diaphragm comprises one of a
2 sphere, a hemisphere, a less than hemispherical section of a sphere, a silo shape, and a filled cone
3 shape.

1 10. The electromagnetic transducer of claim 1 further comprising:
2 a bobbin coupled to the diaphragm and to the voice coil.

1 11. The electromagnetic transducer of claim 10 further comprising a skin encapsulating the
2 diaphragm.

1 12. The electromagnetic transducer of claim 11 wherein the skin further encapsulates the
2 bobbin.

1 13. The electromagnetic transducer of claim 12 wherein the skin further encapsulates the
2 voice coil.

1 14. The electromagnetic transducer of claim 10 wherein the bobbin comprises an integral part
2 of the diaphragm and is constructed of aerogel.

1 15. The electromagnetic transducer of claim 1 configured as an audio tweeter and wherein
2 the diaphragm comprises a dome shape.

1 16. The electromagnetic transducer of claim 1 configured as a compression driver.

1 17. The electromagnetic transducer of claim 1 configured as a microphone.

1 **18.** An electromagnetic transducer comprising:
2 a motor structure;
3 a suspension component coupled to the motor structure; and
4 a diaphragm coupled to the suspension component, wherein the diaphragm comprises
5 more than 50% by volume a nanoporous material.

1 19. The electromagnetic transducer of claim 18 wherein:
2 the diaphragm comprises more than 75% by volume a nanoporous material.

1 20. The electromagnetic transducer of claim 19 wherein:
2 the diaphragm comprises more than 90% by volume a nanoporous material.

1 21. The electromagnetic transducer of claim 20 wherein:

2 the diaphragm comprises more than 95% by volume a nanoporous material.

1 22. The electromagnetic transducer of claim 21 wherein:

2 the diaphragm comprises more than 99% by volume a nanoporous material.

1 23. The electromagnetic transducer of claim 18 wherein:

2 the nanoporous material comprises aerogel.

1 **24.** A tweeter audio speaker comprising:

2 a motor structure having a magnetic air gap;

3 a diaphragm including a substantially solid dome of nanoporous material; and

4 a voice coil coupled to the diaphragm and disposed within the magnetic air gap.

1 25. The tweeter audio speaker of claim 24 further comprising a skin coupled to the dome.

1 26. The tweeter audio speaker of claim 25 further comprising a bobbin coupling the dome to
2 the voice coil.

1 27. The tweeter audio speaker of claim 26 wherein the skin is further coupled to the bobbin.

1 28. The tweeter audio speaker of claim 27 wherein the skin is further coupled to and overlies
2 the voice coil.

1 29. The tweeter audio speaker of claim 28 wherein the skin comprises at least two layers of
2 skin.

1 30. The tweeter audio speaker of claim 26 wherein the bobbin comprises nanoporous
2 material and is monolithic with the dome.

1 31. The tweeter audio speaker of claim 24 wherein the skin comprises at least one of metal,
2 plastic, and oxide.

1 32. The tweeter audio speaker of claim 31 wherein the skin is formed on the dome by at least
2 one of sputtering, chemical vapor deposition, vacuum deposition, laminating, dipping, and
3 painting.

1 33. The tweeter audio speaker of claim 24 wherein the dome has a shape comprising one of
2 spherical, hemispherical, sub-hemispherical, silo-shaped, and filled cone.

1 34. The tweeter audio speaker of claim 24 wherein the nanoporous material comprises at
2 least one of aerogel, solgel, and nanocomposite material.

1 **35.** An audio speaker comprising:
2 a motor structure having a magnetic air gap;
3 a diaphragm including a plastic and a nanoporous material distributed within the plastic
4 so as to be substantially encapsulated by the plastic; and
5 a voice coil coupled to the diaphragm and disposed within the magnetic air gap.

1 36. The audio speaker of claim 35 wherein the diaphragm comprises at least 10% nanoporous
2 material by volume.

1 37. The audio speaker of claim 36 wherein the diaphragm comprises at least 25% nanoporous
2 material by volume.

1 38. The audio speaker of claim 37 wherein the diaphragm comprises at least 50% nanoporous
2 material by volume.

1 39. The audio speaker of claim 35 wherein the diaphragm comprises a plurality of particles
2 of nanoporous material.

1 40. The audio speaker of claim 39 wherein the nanoporous material comprises more than
2 1,000 particles of nanoporous material each less than 1 cubic millimeter in volume.

1 41. The audio speaker of claim 35 wherein the nanoporous material comprises a sheet, and
2 the plastic comprises a plurality of layers sandwiching the sheet of nanoporous material.

1 42. The audio speaker of claim 35 wherein the plastic comprises polypropylene.

1 43. The audio speaker of claim 42 wherein the nanoporous material comprises aerogel.

1 44. The audio speaker of claim 35 wherein the nanoporous material comprises a sheet, and
2 the plastic comprises a plurality of layers sandwiching the sheet of nanoporous material.

1 **45.** An improvement in an audio speaker, the audio speaker comprising,
2 a motor structure including a magnetic air gap; and
3 a diaphragm assembly including,
4 a bobbin,
5 a voice coil coupled to the bobbin and disposed within the magnetic air gap,
6 a suspension component coupling the diaphragm assembly to the motor structure,
7 and
8 a diaphragm coupled to the bobbin;
9 wherein the improvement comprises the diaphragm being comprised of a substantially
10 translucent plastic filled with particles of a substantially translucent nanoporous material.

1 46. The improvement in the audio speaker of claim 45, wherein the improvement further
2 comprises the substantially translucent plastic comprising polymethylpentene.

1 47. The improvement in the audio speaker of claim 46, wherein the improvement further
2 comprises the substantially translucent nanoporous material comprising aerogel.

1 48. The improvement in the audio speaker of claim 47, wherein the improvement further
2 comprises at least some of the particles having a tint added to them.

1 49. The improvement in the audio speaker of claim 48, wherein the improvement further
2 comprises the tint comprising a vapor deposited layer of metal.